



Penny Sweetser, Ph.D.
Senior Designer, 2K Australia

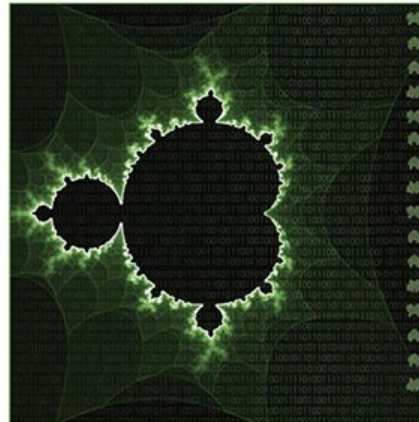
Emergence in Games

Emergence in Games

THOMSON

EMERGENCE IN GAMES

- Provides a detailed, theoretical foundation for understanding emergence in games
- Offers a practical approach to implementing emergence in games
- Defines the next step in game development—a more realistic, open, and natural interaction and behavior in game worlds



GAME DEVELOPMENT SERIES

PENNY SWEETSER

Overview

- Interaction
- Evolution of gameplay
- Emergence
- Emergence in Games
 - Worlds
 - Characters
 - Narrative
 - Societies

Interaction

- Elements of Interaction
 - Consistency
 - Immersion
 - Intuitiveness
 - Freedom

Elements of Interaction

- **Consistency:** the game behaves in a consistent manner, enabling players to learn the rules of the game and to know when and how they can interact
- **Immersion:** the game draws the player into the game, affecting their senses and emotions through elements such as audio, graphics, and narrative

Elements of Interaction

- **Intuitiveness:** the game meets player expectations, in terms of how they would expect to be able to interact with game objects and solve problems in the game world
- **Freedom:** the game affords the player freedom to express their creativity and intentions by playing the game in the way that they want

Evolution of Gameplay

- Four eras of interaction
 - Interactive Fiction
 - Linear Gameplay
 - Sandbox Games
 - Emergent Gameplay

Interactive Fiction

Interactive Fiction requires the player to discover a prescribed story via a set of limited interactions, such as typing in key words, clicking on the interface, or choosing an option from a list



Vogon Hold

33/49

Ford yawns. "Matter transference always tires me out. I'm going to take a nap." He places something on top of his satchel. "If you have any questions, here's The Hitchhiker's Guide to the Galaxy" (Footnote 14). Ford lowers his voice to a whisper. "I'm not supposed to tell you this, but you'll never be able to finish the game without consulting the Guide about lots of stuff." As he curls up in a corner and begins snoring, you pick up The Hitchhiker's Guide.

>CONSULT GUIDE ABOUT EARTH

The Guide checks through its Sub-Etha-Net database and eventually comes up with the following entry:

Mostly harmless.

>CONSULT GUIDE ABOUT VOGONS

The Guide checks through its Sub-Etha-Net database and eventually comes up with the following entry:

Vogons, whose specialties are bureaucracy and planet-smashing, are the most unpleasant race in the Galaxy. They wouldn't think twice about throwing someone into space, and wouldn't lift a finger to save their own grandmother from the Ravenous Bugblatter Beast of Traal. Also see the entries on Vagon poetry and the Ravenous Bugblatter Beast of Traal.

>DON'T PANIC

Why not? Your position appears quite hopeless.

Linear Gameplay

Linear Gameplay involves an underlying story to be discovered, puzzles to solve along the way, and a limited and predetermined set of ways to interact in the game world



Sandbox Games

Sandbox Games are almost simulations, except for the somewhat loose definitions of tasks, challenges, and completion. The player is given basic elements and a set of rules to create their own game



Emergent Gameplay

Emergent Gameplay occurs when interactions between objects in the game world or the player's actions result in a second order of consequence that was not specifically planned by the game developers



Evolution of Gameplay

- Player becomes central
- More realistic and immersive
- Towards more interaction
 - Consistency
 - Immersion
 - Intuitiveness
 - Freedom

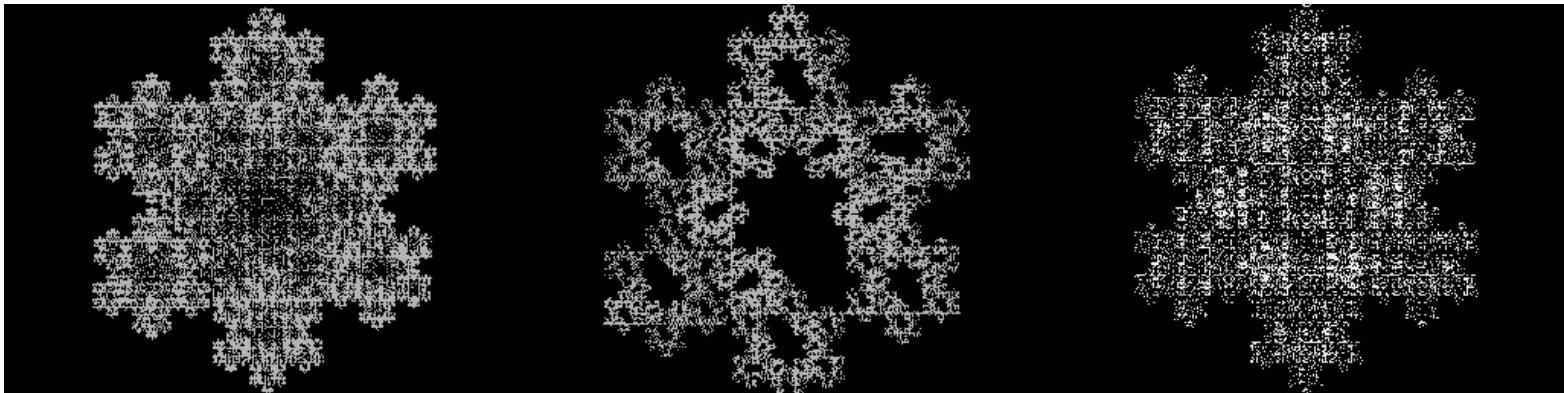
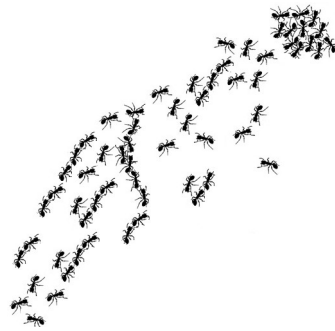
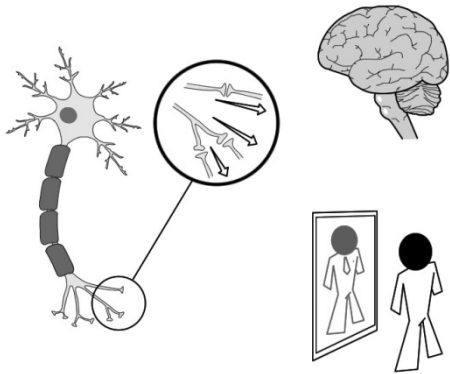
Complex Systems

The whole is more than the sum of its parts
- Aristotle

- Complex systems

- Many interconnected and interdependent parts
- Interaction between parts is fundamental
- Collective behavior is not equal to the sum of its parts, it is emergent

Complex Systems



Emergence

- Properties, behaviours, and structure that occur at higher levels of a system, which are not present or predictable at lower levels
- More is different
- **Local emergence:** collective behavior that appears in small, localized parts of a system
- **Global emergence:** the collective behavior of the entities relates to the system as a whole

Emergence

- Elements of emergent systems:
 - Global phenomena emerge from local interactions of many simple entities
 - There is no evidence of the global phenomena at the local level
 - Global phenomena follow a different set of dynamics

Emergence in Games

- Made possible by defining simple, global rules, behavior, and properties for game objects and their interactions
- **Local emergent gameplay:** a section of a game allows for new behavior that does not have knock-on effects for the rest of the game
- **Global emergent gameplay:** simple low-level rules and properties interact to create new, high-level gameplay that alters how the game plays out

Emergence in Games

- To improve the player's experience
- Not for its own sake
- Can be incorporated to varying degrees
- Can be incorporated in different ways
 - Worlds
 - Characters
 - Narrative
 - Societies

Board Games / Card Games



Worlds

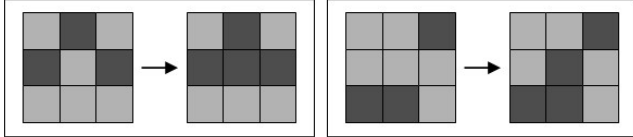
- Possibility space of games
- Constrain the gameplay
- Elements of the world are the elements of play – board and pieces in chess
- Interactions form the gameplay
 - RPG – talking, casting, collecting, upgrading
 - RTS – training, constructing, gathering, attacking
 - FPS – run, jump, duck, hide, shoot, kick, pick up
- Use basic interactions to solve problems, achieve goals, and advance

Emergent Worlds

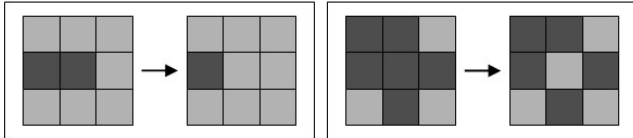
- Types of objects and interactions
- General properties and rules
- Not specific, localised gameplay
- Define a simple, general set of elements and rules that can give rise to a variety of interesting, challenging behaviours and interactions in varying situations
- Rules and elements are constant, situation and configuration change over time

Emergent Worlds

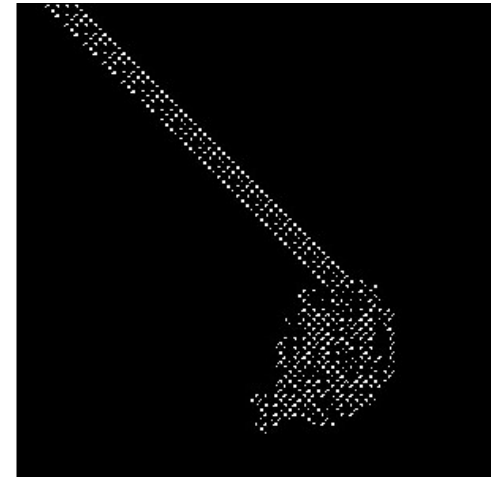
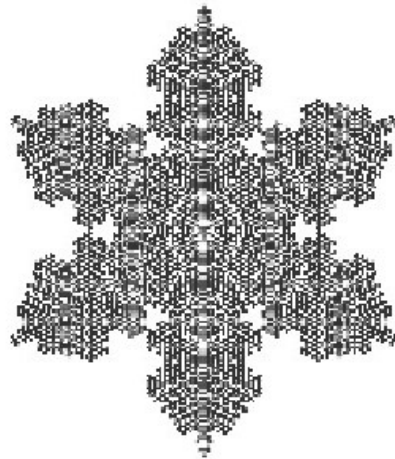
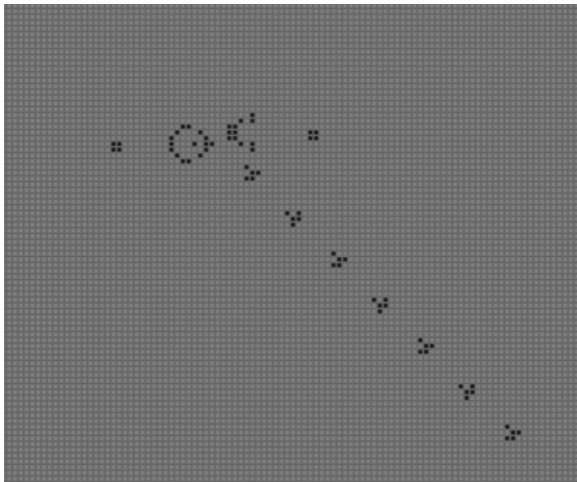
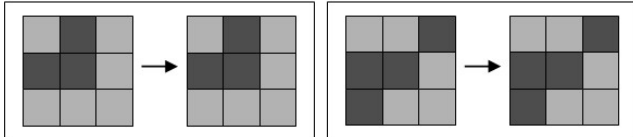
Birth



Death



Survival



Emergent Worlds



Characters and Agents

- Life, story, atmosphere
- Serve many different purposes
 - Units that the player controls
 - Characters that populate a world
 - Enemies that the player fights
- Players identify with characters and expect more from them
- Responsive, reactive, and dynamic characters make for believable and challenging games

Emergent Characters

- Choosing how to react to a game world amplifies the variation and unpredictability
- Actively change the state of the world
- Differences between individual and types of agents adds variation and complexity
- Different agents choose to react to the same situation in different ways

Emergent Characters

- Agents that follow simple rules in response to a complex environment are emergent entities
- Need an awareness of the environment and an ability to react
 - Model of the environment – sensing
 - Set of rules for reacting – acting

Emergent Characters

- Situational awareness
 - An agent's dynamic mental model of its environment and its place in it
 - A sense of what is happening now, what could happen next, what options there are for action, and possible outcomes of those actions
 - Foundation for making decisions in complex environments

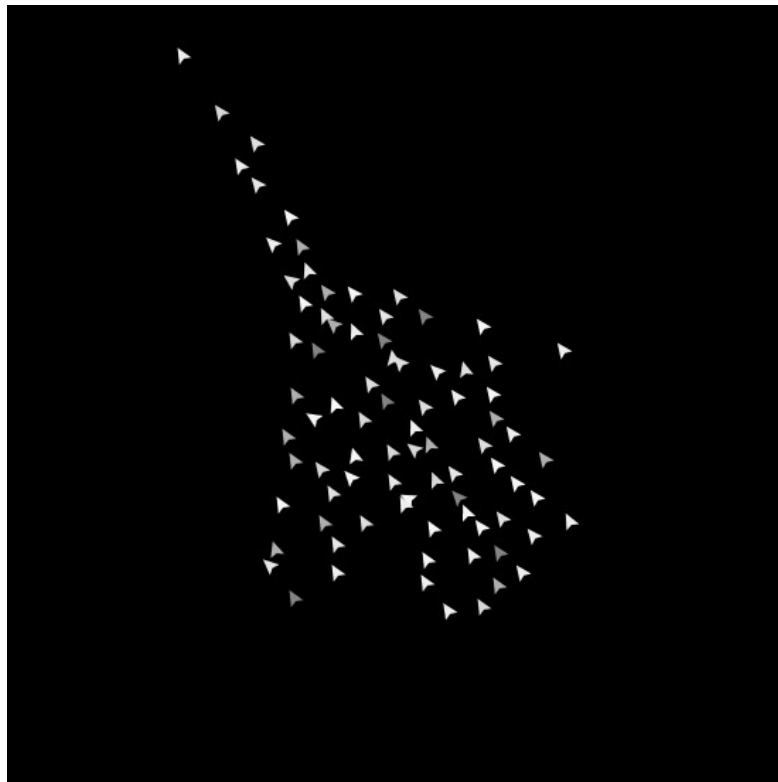
Emergent Characters

- Environmental awareness
 - Crucial to emergent behavior
 - Simple agents in a complex environment
- Emergence comes from:
 - Interactions between agents
 - Interactions between agents and the player
 - Collective interactions of agents with the world

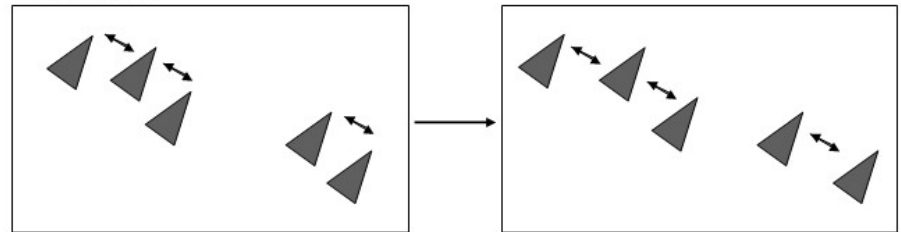
Emergent Characters

- Acting
 - Individual
 - Movement – running away, reposition, charging
 - Decision-making – choosing an action based on goals, personality, state of the game
 - Group – interact, coordinate, cooperate
 - Group movement – agent-based steering behaviours
 - Tactics – cooperate to achieve a group goal

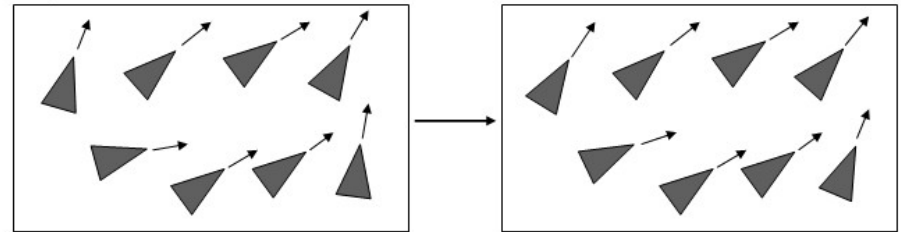
Emergent Characters



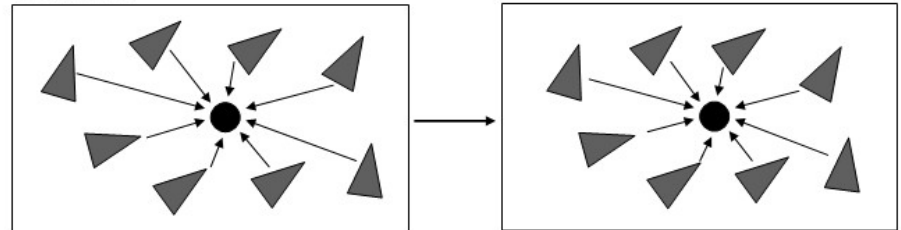
Separation



Alignment



Cohesion



Emergent Characters



Narrative

- Stories that are told, uncovered, or created
- Structures
 - Player as Receiver
 - Player as Discoverer
 - Player as Creator

Narrative

Player as Receiver: narrative is delivered to the player



Narrative

Player as Discoverer: the player actively uncovers the plot



Narrative

Player as Creator: the story is a function of the player's actions and interactions in the game world



Narrative

- Elements

- Storyline

- Overarching plot and subplots that play out in the game
 - Can be received, discovered, or created
 - Often presented in installments throughout the game

- Conversation

- More informal, continuous form of narrative
 - Engaged in or observed by the player
 - Reveal small pieces of info about events, people, and places

Emergent Narrative

- Storyline
 - Player's actions are low-level elements
 - Storyline is high-level behavior
 - Receiver
 - Stories have no connection to player actions
 - Imposed over actions
 - Discoverer
 - Interactions are determined by and forced to fit the story
 - Incorrect or unplanned actions have no consequence
 - Creator
 - Low-level actions and behaviours interact to form the overarching storyline
 - Emergent, but are they compelling, believable, and coherent stories?

Emergent Narrative

- Storytelling continuum
 - Sandbox games – entirely emergent story created from the player's actions
 - Never told to the player, no predefined structure
 - Unlikely to follow an ideal dramatic arc
 - Receiver – entirely delivered to the player, who has no role in its creation
 - Designers have complete control, story is separate from play
 - Break story into components
 - Smaller components give the player more freedom
 - Larger components are preplanned chunks of story
 - Linkage between actions and story

Emergent Narrative

- Aristotle – Muthos and Mimesis
 - Muthos (plot) is the organisation of events to form the overall plot structure
 - Mimesis (mimetic activity) includes the actions and behaviours
- Aristotle defined Mimesis according to Muthos – the structure of the plot determines the actions and behaviours
- To empower players – Muthos and Mimesis should behave like equals

Emergent Narrative

- Story creation
 - Support story creation by making the implicit explicit
 - Track the player's goals and progress – journal, stats
 - Commentaries – play-by-play, colour commentary
 - Self documentation – photo album, movie maker
 - Physically manifest the player's impact in the game world
 - Artifacts, characters, music, lighting, scenery
 - Generate their story
 - Track events, stats, timelines, trends

Emergent Narrative

- Conversation
 - Can be entirely scripted, including the player's part, and play out for the player to observe
 - The player can choose a response from a limited set of options in a conversation tree
 - Have a list of conversation topics to choose from
- Conversations can be emergent if speech options depend on the character having:
 - An awareness of the state of the game world
 - An attitude towards the player
 - A memory of previous interactions
 - Their own motivations and goals
 - Appropriate reactions to the player's choices

Societies

- Social emergence is complex and unpredictable in current games
- Divergence and complexity of real societies
 - Lots of people interacting in unpredictable ways
- Social emergence
 - Economies
 - Social structures
 - Communities
- Artificial social networks

Social Emergence

- Economies
 - Complex, intricate, and difficult to manage
 - MMORPGs have the largest virtual economies
 - Change dynamically with supply and demand, based on trading patterns of the inhabitants
 - Real world phenomena – trading, banking, inflation, gambling

Social Emergence

- Norrath (EverQuest) in 2001
 - 77th largest economy in the world (~Russia)
 - Each character level = US\$13
 - Character generated total capital of US\$15,000/hr
 - Gross national product of US\$135 million
 - Average hourly wage of US\$3.42
 - Exchange rate of US\$0.0107

Social Emergence

- Inflation
 - Average holding per character increases over time
 - Things continuously cost more
 - Destructive actions – farming, hacking
 - Money sinks – things players want that don't affect gameplay
 - Taxation
 - Limiting inventory

Social Emergence

- Real money trading
 - Players acquire in-game assets and sell them for real-world money
 - Events external to the game influence the game economy
 - Alters player motivations
 - Spin off external online marketplaces, auction sites, and currency converters
 - Questions of value and ownership
 - Secondary market sales approx US\$1-3 Billion in 2006
 - Internet cafes and workshops in Taiwan transformed into grinding factories – use low wage currency farmers

Social Emergence

- Social Structures
 - Individual interactions, motivations, and behaviours give rise to complex social structures
 - Governments and political parties form around common beliefs, desires, or goals
 - Governments institute laws and punish law-breakers
 - The Sims Online – emergent government system with a player-elected President and Cabinet in Alphaville
 - Virtual crimes – thefts, assaults, prostitution, bullying
 - Virtual death penalty enforced in LambdaMOO against Mr. Bungle
 - Mafia – powerful players threaten new players for protection money and conduct organised crime
 - The Sim Mafia in Alphaville
 - Political demonstrations – equality in virtual and real life

Social Emergence

- Communities
 - Players form strong social bonds over time
 - Communities form inside and outside of games
 - Guilds, forums, competition ladders, mod communities
 - Supporting communities helps to sustain long-term interest

Social Emergence

- Artificial social networks
 - Translate multiplayer social dynamics into single-player games
 - Allow game characters to form social relationships with the player and other characters
 - Adds life and interaction to game worlds
 - Attribute characters with status, social connections, memory of other characters, attitude towards characters and the player
 - Use to determine flow of information in game worlds and behavior in social situations
 - Allow for emergent social interactions and character behaviour

Questions

Contact:

penny@emergenceingames.com

www.emergenceingames.com